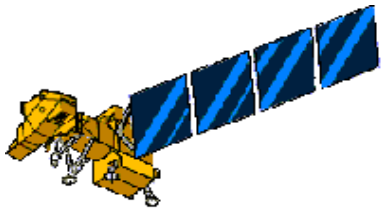
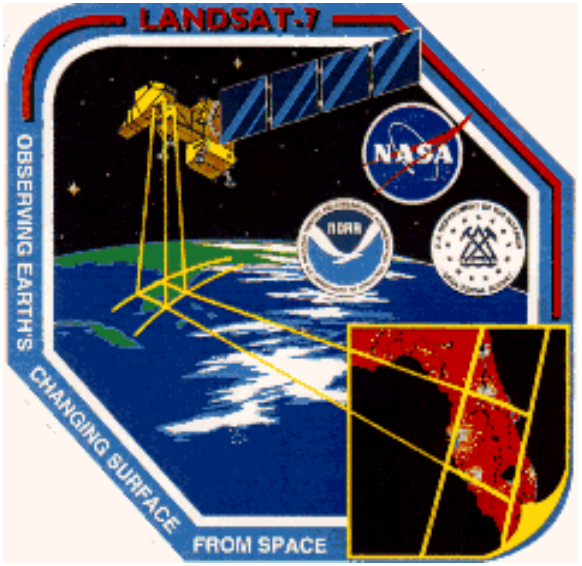
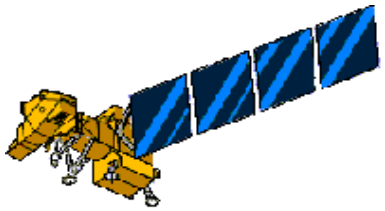


LANDSAT 7 to IGS ICD and OA Status

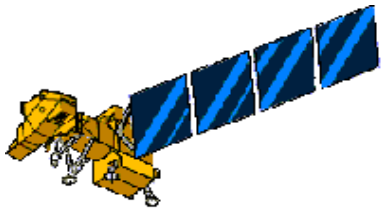


Presenter: Kirk Liang
Org./Co: NOAA/NESDIS
Email: kliang@nesdis.noaa.gov

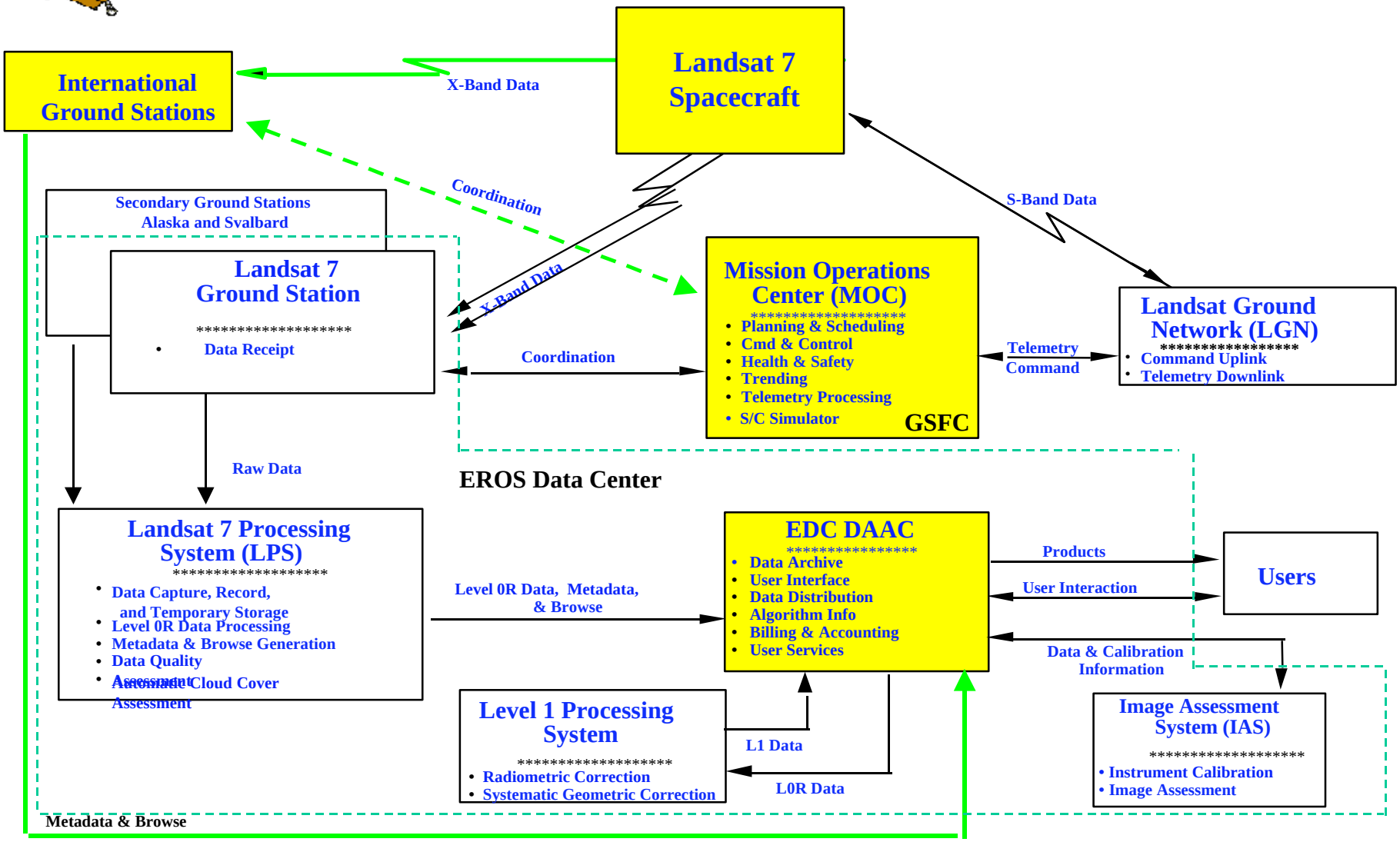


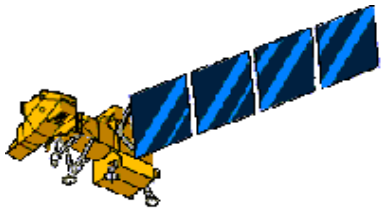
Landsat 7 to IGS ICD

- Introduction:
  - The Landsat 7 to International Ground Stations (IGS) Interface Control Document (ICD) defines the hardware, software, data transfer, and operating interface requirements between the IGS and Landsat 7 system.
  - Current ICD version: Revision B dated February 1998
  - Next update planned for summer of 1998



Landsat 7 Ground System





Landsat 7 to IGS ICD

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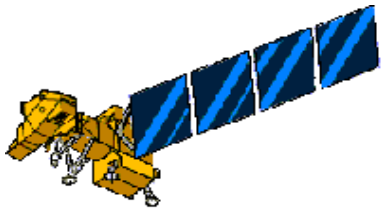
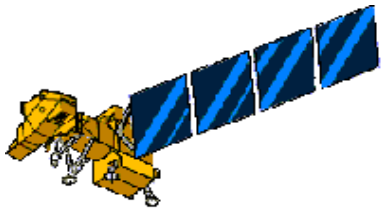


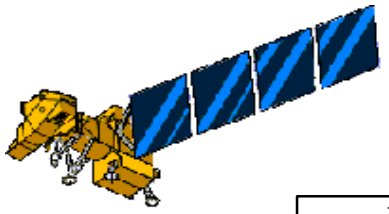
Landsat 7 to IGS ICD

- **Interface Elements**
  - **Mission Operations Center (MOC):** Located in GSFC, Bldg 32; receives service request from IGS and provides contact schedules for ETM+ data downlink and orbital products (NORAD 2-line elements, BMEs, and IIRVs) to IGS
  - **Landsat 7 satellite:** Provides 150 Mbps ETM+ image data downlink to IGS via one of three X-band data frequencies.
  - **EDC DAAC:** Located in EROS Data Center, Sioux Falls, South Dakota. EDC DAAC archives Landsat 0R data, metadata, and browse data to support users queries and distribution. EDC DAAC accepts metadata and browse data (optional) from IGS.

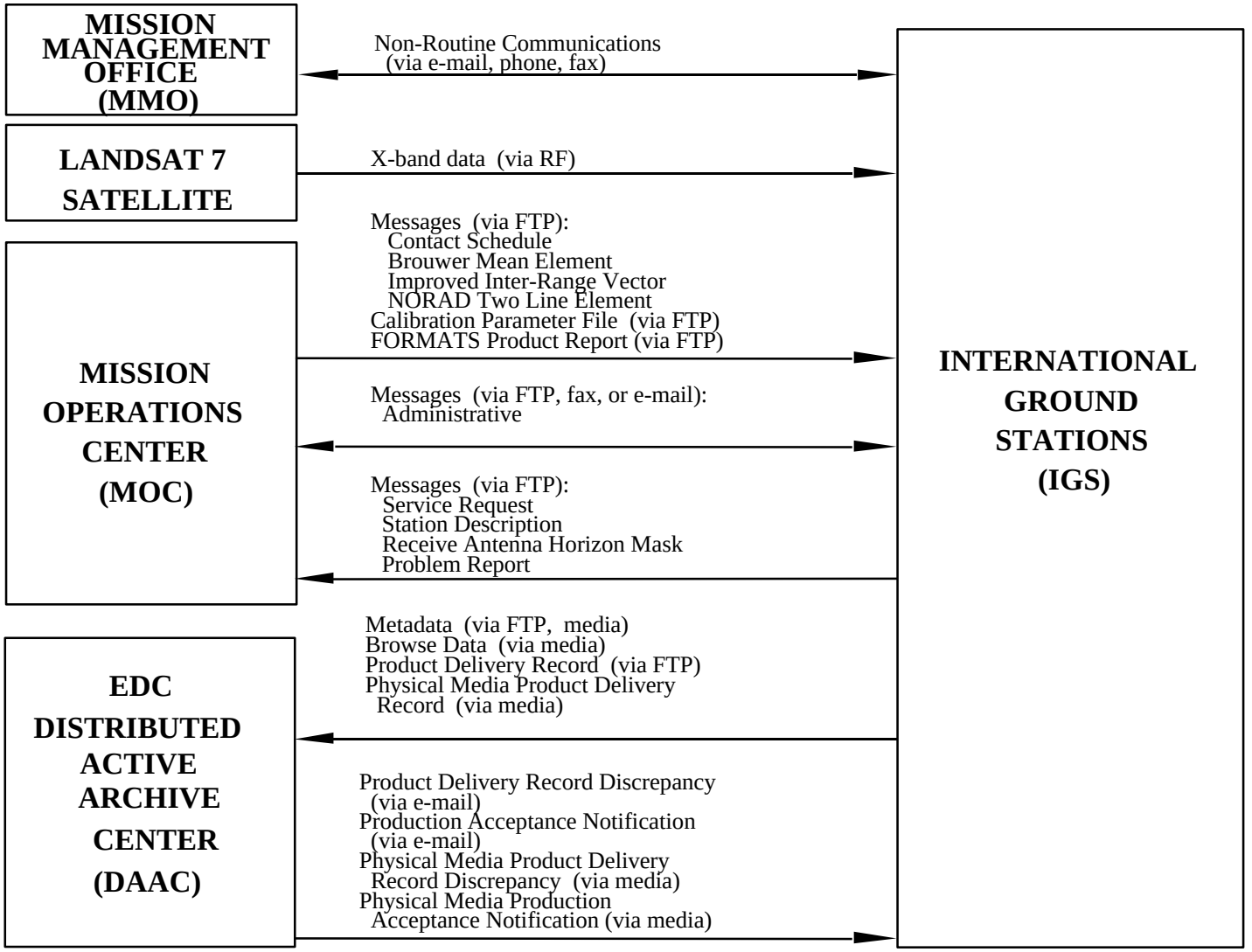


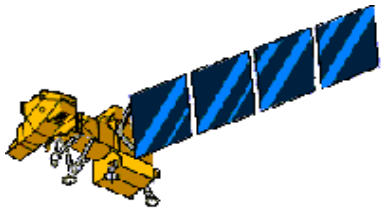
Landsat 7 to IGS ICD

- **Interface Elements** (Continue)
  - **Mission Management Office (MMO):** Established by NOAA to implement the Landsat 7 data policy. MMO is responsible for day-to-day operations of the Landsat 7 system, and maintains policy and operations agreements with IGSs. MMO will coordinate non-routine operations service and communications with the IGSs.
  - **IGS:** Interface directly with Landsat 7 satellite to receive real-time ETM+ data and process it for archive and distribution. ETM+ transmission to IGS is scheduled by the MOC according to requests sent in from the IGS.



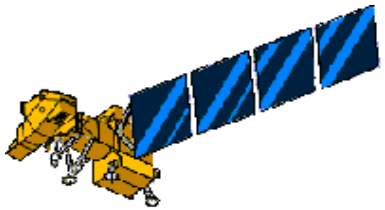
Landsat 7 to IGS ICD





Messages and Products

- There are five modes of communication for IGS interface:
  - File Transfer Protocol (FTP “put” and “get”)
  - Electronic Mail (e-mail)
  - Physical media delivery (Tape)
  - Fax
  - Telephone
- The primary means for IGS communication with the MMO, and the MOC is electronic transfer (FTP) of text base messages and reports.
- The primary means for IGS communication with the DAAC are electronic transfer, Physical media, and e-mail.

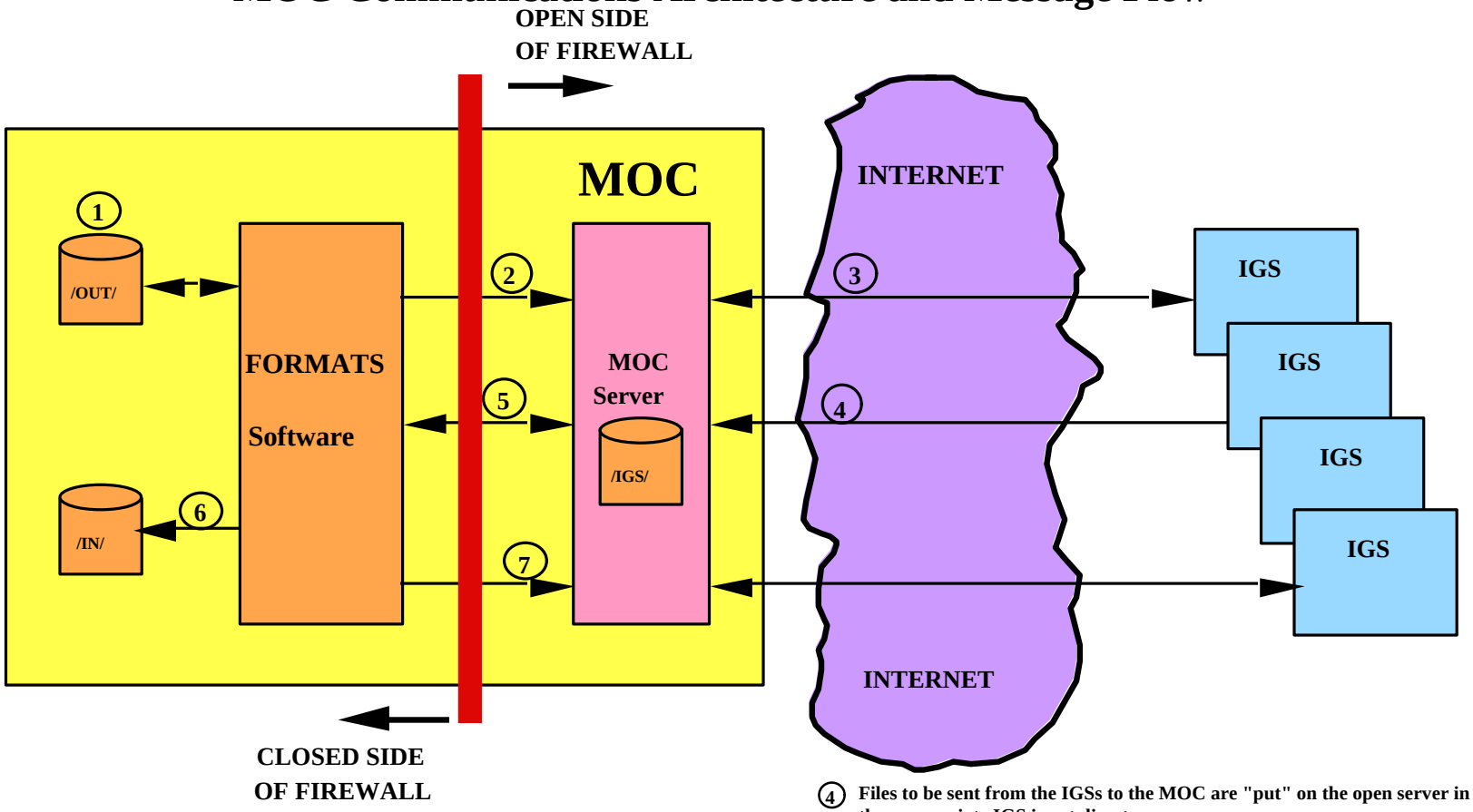


Messages and Products

Messages & Products	From/To	Media
Acquisition Files (IIRV, BME, NORAD)	MOC to IGS	FTP
Calibration Parameter File	MOC to IGS	FTP
Contact Schedule Message	MOC to IGS	FTP
FORMATS Product Report	MOC to IGS	FTP
Administrative Message	MOC to IGS, IGS to MOC	FTP
Service Request Message	IGS to MOC	FTP
Problem Report Message	IGS to MOC	FTP
Station Description Message	IGS to MOC	FTP
Receive Antenna Horizon Mask Message	IGS to MOC	FTP
Metadata File	IGS to DAAC	FTP, Physical media
Browse Data File	IGS to DAAC	Physical media
Product Delivery Record File (PDR)	IGS to DAAC	FTP, Physical media, or hard copy
PDR Discrepancy File (PDRD)	DAAC to IGS	E-mail
Production Acceptance Notification (PAN)	DAAC to IGS	E-mail
Physical Media Product Delivery Record File (PMPDR)	IGS to DAAC	Physical media, or hard copy
Physical Media PDR Discrepancy File (PMPDRD)	DAAC to IGS	E-mail
Physical Media Production Acceptance Notification File (PMPAN)	DAAC to IGS	E-mail

Landsat 7 to IGS ICD

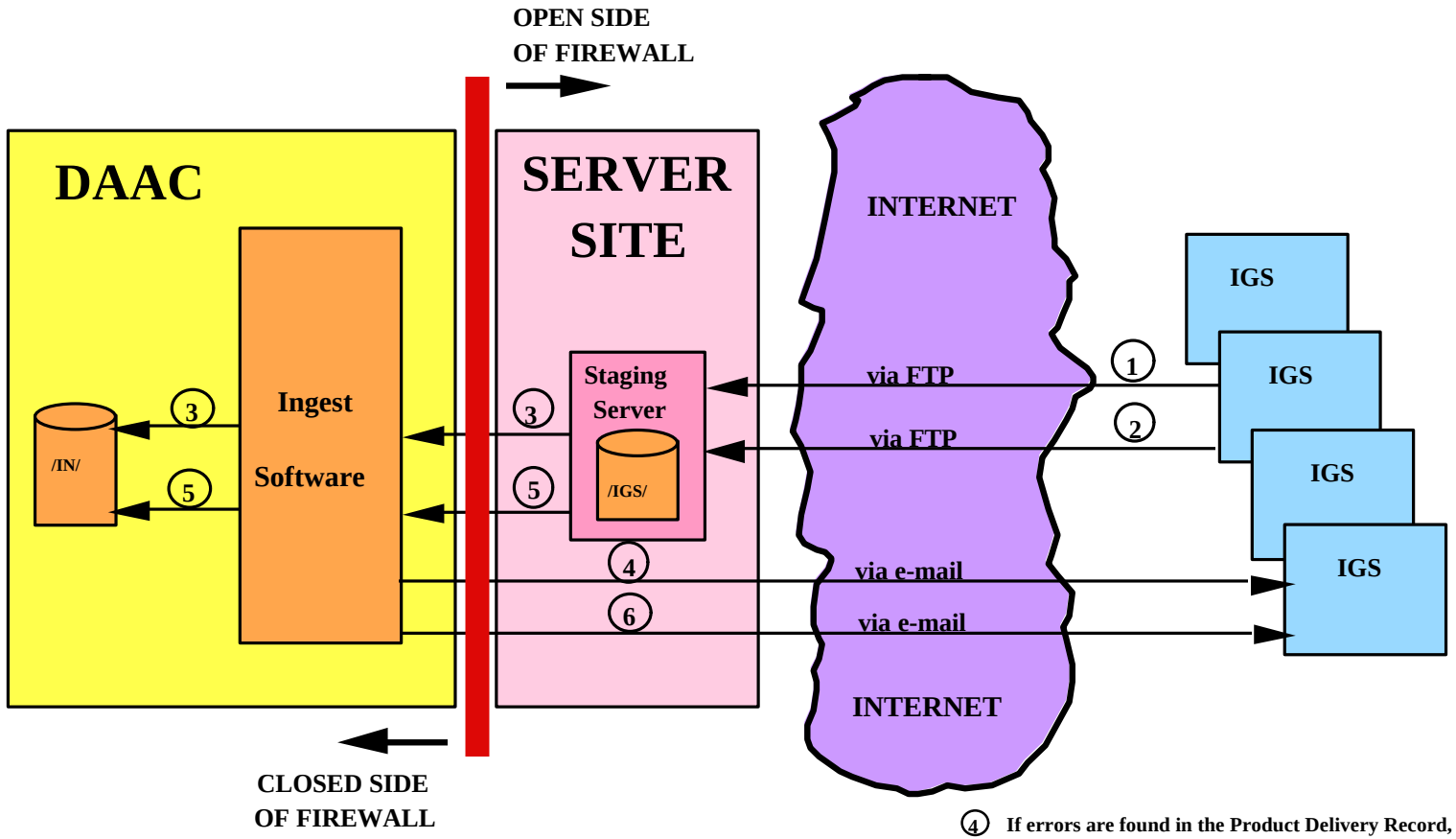
MOC Communications Architecture and Message Flow



1. Files (messages) to be sent from the MOC to the IGSs are placed in MOC output directories for pickup by FORMATS.
2. FORMATS polls the MOC output directories for IGS files and places them on the open server in the appropriate IGS output directory.
3. The IGSs poll the open server and "get" files via FTP.
4. Files to be sent from the IGSs to the MOC are "put" on the open server in the appropriate IGS input directory.
5. FORMATS polls the open server and "get"s files via FTP.
6. Files are validated and transferred to the appropriate MOC server.
7. FORMATS generates Product Report as acknowledgment of files received from the IGS and transferred into the MOC, or to report errors found during validation of the Service Request message.

Landsat 7 to IGS ICD

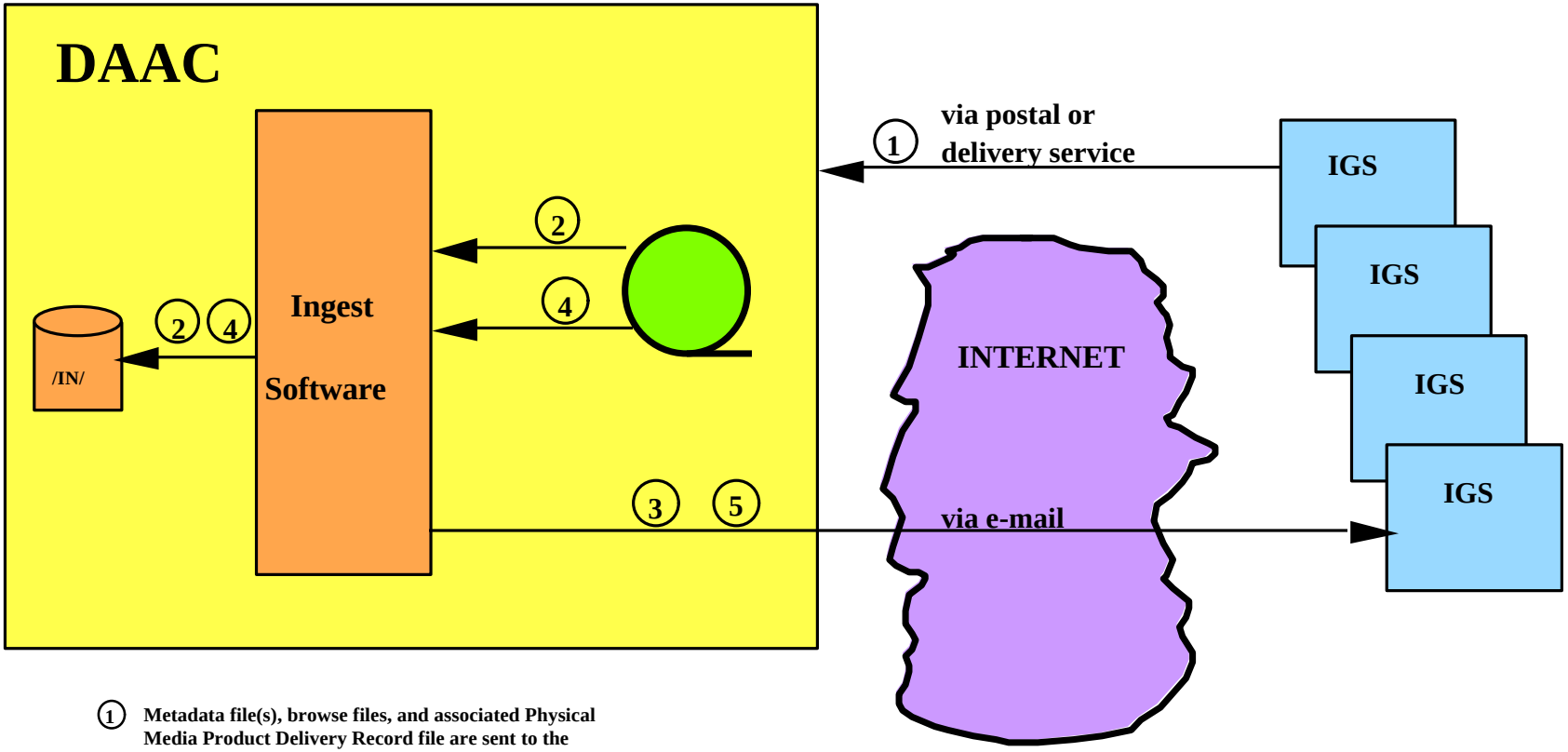
DAAC Communications Architecture and Data Flow for Electronic Transfer



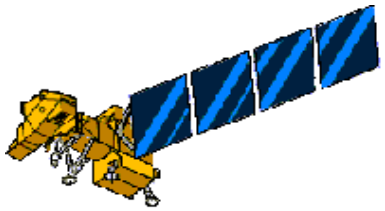
1. Metadata file(s) are sent to the staging server from the IGS via FTP and "put" in the /DATA directory.
2. The associated Product Delivery Record file is then sent to the staging server from the IGS via FTP, and "put" in the /PDR directory.
3. The Product Delivery Record is processed first.
4. If errors are found in the Product Delivery Record, they are reported in the Product Delivery Record Discrepancy file which is sent via e-mail to the IGS.
5. After no errors are found in the Product Delivery Record, metadata is ingested and processed.
6. Results of metadata processing are reported in the Production Acceptance Notification file which is sent to the IGS via e-mail.

Landsat 7 to IGS ICD

DAAC Communications Architecture and Data Flow for Physical Media Transfer

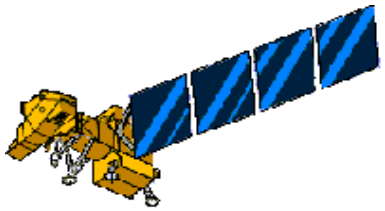


1. Metadata file(s), browse files, and associated Physical Media Product Delivery Record file are sent to the DAAC from the IGS on physical media via postal or delivery service.
2. The Physical Media Product Delivery Record is processed first.
3. If errors are found in the Physical Media Product Delivery Record, they are reported in the Physical Media PDR Discrepancy file which is sent via e-mail to the IGS.
4. After no errors are found in the Physical Media Product Delivery Record, metadata and browse data are ingested and processed.
5. Results of metadata and browse data processing are reported in the Physical Media Production Acceptance Notification file which is sent to the IGS via e-mail.



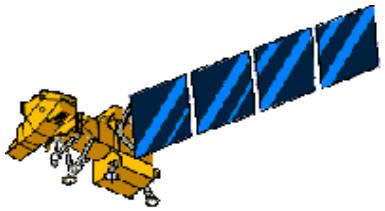
File Naming Conventions

TYPE	DESCRIPTION	FULL FILE NAME *
ADM	Administrative	L7yyyydddxxxADM.Snn
PRB	Problem Report	L7yyyydddxxxPRB.Snn
REQ	Service Request	L7yyyydddxxxREQ.Snn
SCH	Contact Schedule	L7yyyydddxxxSCH.Snn
DES	Station Description	L7yyyydddxxxDES.Vnn
MSK	Receive Antenna Horizon Mask	L7yyyydddxxxMSK.Vnn
BME	Brouwer Mean Element	L7yyyydddxxxBME.Snn
IRV	Improved Inter-Range Vector	L7yyyydddxxxIRV.Snn
NOR	NORAD Two Line Element	L7yyyydddxxxNOR.Snn
CPF	Calibration Parameter File	L7CPFyyyymmdd_yyyymmdd.nn
—	FORMATS Product Report	[Original file name]xRPT
—	Metadata File	L7xxxpppprrryyyymmddf.MTA
—	Browse Data File	L7xxxppprrryyyymmdd.Rnn
PDR	Product Delivery Record File	IGSxxx.yyyymmddhhmmss.PDR
PDRD	PDR Discrepancy File	IGSxxx.yyyymmddhhmmss.PDRD
PAN	Production Acceptance Notification File	IGSxxx.yyyymmddhhmmss.PAN
PMPDR	Physical Media Product Delivery Record File	IGSxxx.yyyymmddhhmmss.PMPDR
PMPDRD	Physical Media PDR Discrepancy File	IGSxxx.yyyymmddhhmmss.PMPDRD
PMPAN	Physical Media Production Acceptance Notification File	IGSxxx.yyyymmddhhmmss.PMPAN



Administrative Message

- Administrative Message will be utilized by both the MOC and IGS for routine communication, such as:
  - To pass administrative information
  - To notify each other of anomalous conditions
  - Delay in Contact Schedule Message update
  - Notice of acquisitions not scheduled
  - Notice of Calibration Parameter File update
  - Notice of system and spacecraft status
- Each IGS is encouraged to use an Administrative Message to resolve any issue with the MOC regarding Landsat 7 ETM+ data downlink.
- Administrative Message will be passed along to MMO when the MOC/FOT can not resolve the issue.



Example of Administrative Message

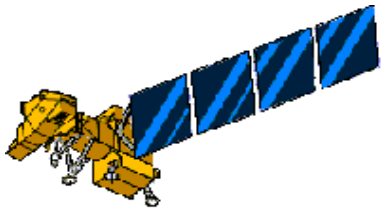
TYPE: ADM

DTG: 1998/127:12:00:00

TEXT: This is a test message from Ellickson for
the LGSOWG - 27 Technical Session.
Upon receiving this, please e-mail me
to confirm receipt. Thank you.
Jim Ellickson
jellickson@nesdis.noaa
301-286-8311

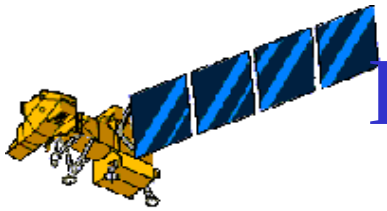
End message

TEXTEND:



Service Request Message

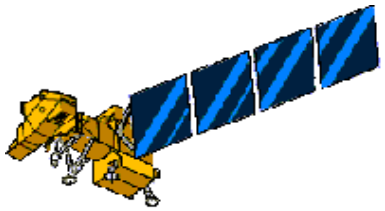
- Service Request Message is used by IGS for requesting an ETM+ image real-time downlink from the MOC
- Each message can have up to 10 requests for different contact times.
- Service Request Message ingested by MOC will be validated upon receipt and an acknowledge report will be sent back to IGS. If error was encountered during validation, it is described in the acknowledge report.



Example of Service Request Message

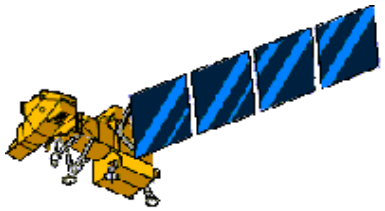
TYPE: REQ
DTG: 1998/127:08:00:00
S/C ID: 7
START PATH: 090
START ROW: 075
STOP ROW: 090
EFFECTIVE DATE: 1999-07-12
EXPIRATION DATE: 1999-08-29
ACQ. RATE: 0
MINIMUM GAP: 016
MAX. SOLAR ZENITH ANGLE:
REQ. TYPE: HOA

S/C ID: 7
START PATH: 089
START ROW: 074
STOP ROW: 090
EFFECTIVE DATE: 1999-07-12
EXPIRATION DATE: 1999-08-29
ACQ. RATE: 0
MINIMUM GAP: 016
MAX. SOLAR ZENITH ANGLE:
REQ. TYPE: HOA
TEXTEND:



Contact Schedule Message

- Contact Schedule messages notify IGS when the requested ETM+ downlink are scheduled.
- Contact Schedule can have multiple schedule acquisition events up to 48 hours of events. However, the second 24 hour may change when re-schedule on the next day.
- If there is no scheduled acquisition, the message will only contain the keywords TYPE, DTG, and TEXEND.



Example of Contact Schedule Message

TYPE: SCH

DTG: 1998/128:20:59:55

SCHEDULED EVENT:

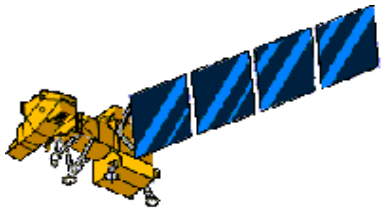
7 1999-07-06:22:58:33 22:58:39 1999-07-06:23:05:26 23:05:27 XL 1

TEXTEND:

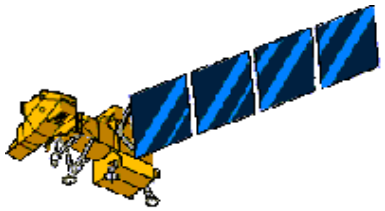
Example of Station Description Message

TYPE:	DES
DTG:	1998/069:14:00:59
EFFECTIVITY:	1998/070
STATION ID:	ASA
CONTACT PERSON:	Warren Serone
CONTACT TITLE:	Acquisitions Manager
MAILING ADDRESS 1:	Australian Centre for Remote Sensing
MAILING ADDRESS 2:	Data Acquisition facility
MAILING ADDRESS 3:	Health Road, P.O. Box 1461
MAILING ADDRESS 4:	Alice Springs 0871, AUSTRALIA
VOICE PHONE NO:	011 61 8 8952 3911
FAX PHONE NO:	011 61 8 8953 0557
IGS E-MAIL ADDRESS To BE USED BY THE MOC/MMO:	acresdaf@auslig.gov.au
IGS E-MAIL ADDRESS To BE USED BY THE DAAC:	acresdaf@auslig.gov.au
ORBITAL ELEMENTS TYPE:	NOR
ANTENNA LATITUDE:	S 23 45 32
ANTENNA LONGITUDE:	E 133 52 65
ANTENNA ALTITUDE:	578
X-BAND FREQ. HIGH:	YES
X-BAND FREQ. MID:	YES
X-BAND FREQ. LOW:	YES
NEED S-BAND BEACON:	YES

TEXTEND:

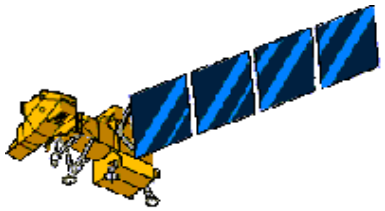


Operations Agreement (OA) Between IGS and Landsat 7



OA Between Landsat 7 & IGS

- Introduction:
  - The Operations Agreement (OA) specifies and controls the operational interfaces between International Ground Stations (IGSs) and the Landsat 7 System. The OA covers the operational interfaces between the IGS personnel and Landsat 7 personnel, which include MMO, MOC, and the EDC Distributed Active Archive Center (DAAC) personnel.
  - Current Version: March 1998 (Draft)
  - Next Update planned for June 1998



OA Between Landsat 7 & IGS

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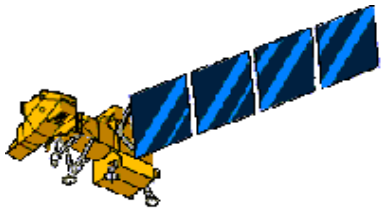
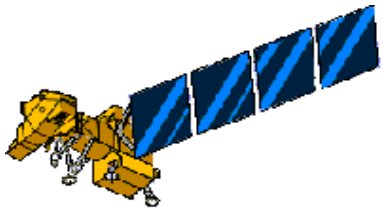


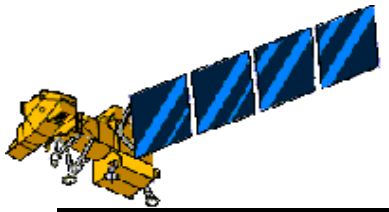
MMO Operational Responsibilities

- Start-up of new stations
- Negotiation of IGS and NOAA Memorandum of Understanding on behalf of Landsat Coordinating Group.
- Maintenance of IGS and Landsat 7 Operations Agreement
- Billing and Accounting for IGS access fee and provision of quarterly accounting information.
- Anomaly Resolution related to direct downlink of Landsat-7 ETM+ data.
- Schedule Conflict Resolution to provide a mutually agreeable resolution in accordance with MOU/OA
- MMO organizes and chairs the LGSOWG



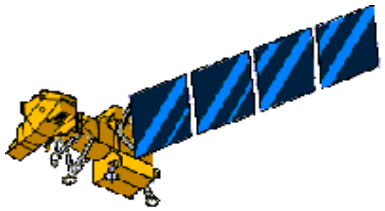
MOC/FOT Operational Responsibilities

- MOC is located in Building 32 at GSFC, Greenbelt, Maryland and is staffed by the Landsat 7 Flight Operations Team (FOT) 24 hrs/day after launch.
- MOC provides hardware and software systems for realtime spacecraft operation, scheduling, and analysis activities.
- MOC provides all command and control function of the spacecraft.
- MOC Open Server provides the messages interface between the MOC and IGS.
  - User ID and password will be assigned to each IGS
- The FOT plans and schedules Landsat 7 ETM+ data downlinks from the MOC; Mission Planning support will only be available during normal working hours.



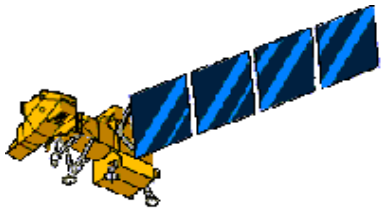
MOC and IGS Products

Product	Description	From/To	Time-span	Frequency
Acquisition Files (IIRV, BME, NORAD)	LS7 position and velocity vectors, orbital elements for IGS pointing to LS7	MOC to IGS	72/96 Hrs, single vector	Monday, Wednesday, and Friday
Calibration Parameter File	Provides geometric and radiometric parameters for image processing	MOC to IGS	N/A	Once before launch and update every 90 days
Contact Schedule Message	Notifies the station of scheduled X-band on/off times	MOC to IGS	48 Hrs	Daily
FORMATS Product Report	Acknowledge receive and ingest of IGS inbound files, and validation of service requests	MOC to IGS	N/A	Within 5 minutes of product receipt
Administrative Message	Free form information not covered by other messages/files	MOC to IGS, IGS to MOC	N/A	As needed
Service Request Message	Request FOT to schedule X-band transmission	IGS to MOC	Up to 10 imaging interval	At least 36 hours prior to start of the requested acquisition
Problem Report Message	Report potential satellite related problems during downlink receipt	IGS to MOC	N/A	Within 24 hours of detection of problem
Station Description Message	Privides FOT with information about IGS loction and POC	IGS to MOC	N/A	Once at station startup; update as required, send at least 7 days prior to effective date.
Receive Antenna Horizon Mask Message	Provides minimum elevation angles for unobstructed line of sight to satellite	IGS to MOC	N/A	Once at station startup; update as required, send at least 7 days prior to effective date.



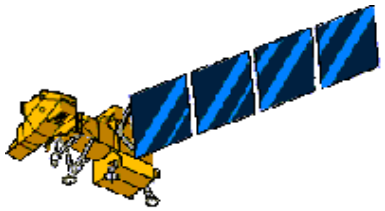
DAAC Operational Responsibilities

- DAAC is located at EROS Data Center (EDC) in Sioux Falls, South Dakota.
- DAAC archives and distributes Landsat 7 Level 0R data, metadata, and browse data from Landsat 7 and metadata, and browse data from IGSs.
- DAAC accepts metadata, browse data and Product Delivery Record (PDR) from IGS and provides accounting of those deliveries to MMO.
- DAAC Staging Server is setup to interface electronically with IGSs for FTP of metadata, PDR and browse data (optional).



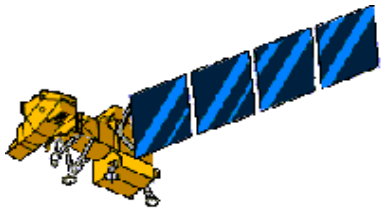
DAAC and IGS Products

Product	Description	From/To	Medium	Frequency
Metadata	Provides information about ETM+ scene acquired	IGS to DAAC	FTP, or Physical media	At least once every 30 days
Browse Data	Reduced volume representation of image used to determine ground coverage and spatial relationships	IGS to DAAC	Physical media	At least once every 30 days
PDR	Describes source, contents, and internal labeling of product	IGS to DAAC	Electronic (FTP), Physical media, or hard copy	Delivered with the metadata or browse data product
PDR Discrepancy	Report problem found during PDR processing	DAAC to IGS	E-mail	As needed
PAN	Reports processing status for every metadata file submitted to DAAC	DAAC to IGS	E-mail	After ingest of each delivery
PMPDR	Describes source, contents, and internal labeling of product	IGS to DAAC	Physical Media, Hard copy	Delivered with the metadata or browse data product
PMPDR Discrepancy	Report problem found during PDR processing	DAAC to IGS	E-mail	As required
PMPAN	Reports processing status for every metadata file submitted to DAAC	DAAC to IGS	E-mail	After ingest of each delivery



FTP Procedure and Problem Resolution

- FTP To MOC/DAAC server with the assigned User name and Password.
- Change directory to where IGS files for transfer
  - cd /IGS/META/XXX/DATA (for DAAC)
  - cd /LS7/ProductRepository/Inbound/Station/<country name>/XXX/Products (for MOC)
- Use “get” or “put” command to transfer files, type “bye” to terminate session
- Contact your local System Administrator first if you have problem with your workstation/PC or network
- Contact MOC/DAAC operations personnel if you encounter user ID error or cannot access the correct directory.



IGS Points of Contact

- The following information is requested from each IGS:

Country: _____

Station: _____

Name & Title: _____ (Administrative Manager)

Phone: _____

Fax: _____

Email: _____

Address: _____

Name & Title: _____ (Operation Manager)

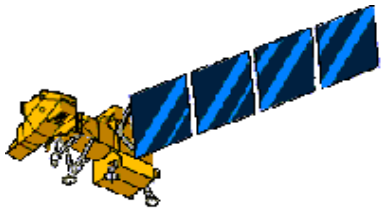
Phone: _____

Fax: _____

Email: _____

Address: _____

– IGS with more than one ground station shall provide POC for all ground stations.



Reference Documents

(1) CCSDS 701.0–B–1, October 1989, Recommendations for Advanced Orbiting Systems, Networks and Data Links, CCSDS Secretariat, Communications and Data Systems Div. (Code–TS), National Aeronautics and Space Administration, Washington, DC 20546

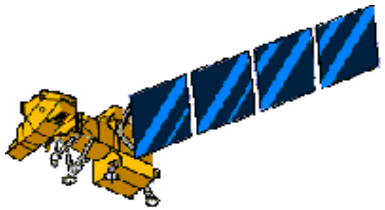
(2) 430-11-06-008, Landsat 7 Data Format Control Book (DFCB) Volume I - Data Acquisition Plan (http://ltpwww.gsfc.nasa.gov/IAS/htmls/l7_review.html)

(3) 23007702-IV, Landsat 7 System Data Format Control Book (DFCB) Volume IV - Wideband Data (http://ltpwww.gsfc.nasa.gov/IAS/htmls/l7_review.html)

(4) 430-11-06-007, Landsat 7 Data Format Control Book (DFCB) Volume V - Level 0R Product Distribution Format (http://ltpwww.gsfc.nasa.gov/IAS/htmls/l7_review.html)

(5) JPL D-7669 Part 2, Planetary Data System Standards Reference, Chapter 12, Object Description Language (ODL) Specification and Usage (http://pds.jpl.nasa.gov/stdref/chap12.htm)

(6) 430-15-01-003, Landsat 7 Science Data Users Guide (http://ltpwww.gsfc.nasa.gov/IAS/htmls/l7_review.html)



Reference Documents (Cont.)

(7) 430-14-01-006, Landsat 7 Operations Agreement (OA) between the International Ground Stations (IGSs) and Landsat 7, future location - not yet available: (http://ltpwww.gsfc.nasa.gov/IAS/htmls/l7_review.html)

(8) Hierarchical Data Format (HDF) User's Guide, University of Illinois at Urbana-Champaign National Center for Supercomputing Applications (NCSA) (http://hdf.ncsa.uiuc.edu/doc.html)

(9) James Ellison and Jaime Milstein (1995) Improved Reduced-Resolution Satellite Imagery

(http://lps-server.gsfc.nasa.gov/!Studies/Techinal_Studies.html)

(10) A Report on Landsat Browse Generation using Wavelets for Image Reduction, Pena, Sept. 1994

(http://lps-server.gsfc.nasa.gov/!Studies/Techinal_Studies.html)

(11) Landsat 7 Long Term Plan (LTP) for Global Archive Refresh. (future location - not yet available: http://ltpwww.gsfc.nasa.gov/IAS/htmls/l7_review.html)